Claims

1. Pressure control system with a pressure control device (1) for maintaining a constant predetermined excess pressure arranged in a fluid dispensing container (50; 60), said pressure control device comprises a first cylinder (15) having an open end and a closed end, and a piston (13) movable within said first cylinder defining a first chamber (16) filled with a gas exerting said predetermined excess pressure, a second chamber (7), a passageway from the second chamber (7) to the outside of the device leading to the container (50; 60), a valve (18, 23) for releasing and closing said passageway, wherein the second chamber (7) being filled with a gas at a pressure higher that said predetermined excess pressure, and said piston (13) having means for actuating said valve dependent from the pressure difference between the first chamber (16) and the container (50; 60), so that if the fluid pressure in the container drops below the predetermined excess pressure, gas flows from the second chamber (7) to the container until the container pressure approximately equals said predetermined pressure, characterized in that the second chamber is substantially a second cylinder (2) with a closed end (34) and an open end provided with a rim part (4), on which a closure (5) is mounted to close the second chamber, such that the second chamber is encompassing the first chamber, wherein the first chamber is part of the closure.

2. Pressure control system as claimed in claim 1, wherein the volume of the first chamber (16) is substantially smaller than the volume of the second chamber (7).

3. Pressure control system as claimed in claim 2, wherein the initial pressure of the gas in the second chamber (7) is defined by the formula:

$$P_2 \geq P_1 * (1 + V_1 / V_2)$$

wherein P_1 = the predetermined excess pressure
P_2 = the initial pressure in the second chamber

V_1 = the volume of the container
V_2 = the volume of the second chamber

4. Pressure control system as claimed in one of claims 1 to 3, wherein the closure (5) comprises a closing element (9A, 9B) commensurate to the rim part (4) of the second cylinder (2) and means (26) for mounting the first cylinder (15) of the first chamber in the closure (5).

5. Pressure control system as claimed in claim 4, wherein the upper end of the second cylinder (2) has a tapered neck portion (3).

6. Pressure control system as claimed in claim 5, wherein the closure (5) comprises a steplike funnel (6) directed inwardly to the neck portion (3).

7. Pressure control system as claimed in claim 4 or 5, wherein the closing element is an inner circular groove (10) of the closure (5) which is mounted to the rim part (4) of the second cylinder by means of vibration or ultrasonic welding.

8. Pressure control system as claimed in one of claims 1 to 7, wherein the second cylinder (2) has a central bottom opening (36) locked by a plug (37) for pressurizing the second chamber (7) with a gas.

9. Pressure control system as claimed in claim 1, wherein the second cylinder (2) is made of a plastic material by injection blow moulding.

10. Pressure control system as claimed in claim 9, wherein the second cylinder (2) is made of PET.

11. Pressure control system as claimed in one of claims 1 to 10, wherein the container (50; 60) is formed from a plastic material as a cylindrical bottle and the second cylinder (2) is welded to the inner wall of the container.

12. Pressure control system as claimed in claim 11, wherein the second cylinder (2) is laser welded to the inner wall of the container (50; 60).

13. Pressure control system as claimed in claim 11 or 12, wherein the container (50) has a dispensing opening with a dispensing valve (51), and a movable piston (52) is provided in the container between the pressure control device and the dispensing opening, which piston is separating the fluid and the gas, and which is movable towards the dispensing opening by the excess pressure prevailing in the container.

14. Pressure control system as claimed in claim 13, wherein the movable piston (52) is designed as a dome with annular sealing ribs (53, 54).

15. Pressure control system as claimed in claim 14, wherein the movable piston (52) is made of a resilient plastic material.

16. Pressure control system as claimed in claim 11 or 12, wherein the container (60) has a dispensing opening (61) with a dispensing valve (62), and a dip-tube (68) is provided from the entry of the dispensing valve (62) to the upper end of the pressure control device (1), in order to dispense the fluid through the dip-tube by the excess pressure prevailing in the container.

17. Pressure control system as claimed in claim 16, wherein the dispensing valve (62) has a spray nozzle (64).

18. Method for manufacturing a pressure control system as claimed in one of claims 1 to 17, wherein a container (50; 60) is formed; the bottom of the container is cut off; the first cylinder (15) is formed; the piston (13), the valve elements (18, 23) and the second cylinder (2) with the closed end and the closure (5) of the pressure control device (1) are formed out of a synthetic material of high stability; a central opening (36) is formed in the bottom of the second cylinder (2); the piston (13) is assembled with a sealing ring (14) in the first cylinder (15), whereas a gas is filled in the first chamber (16) at a predetermined pressure; the first cylinder (15) is mounted with respect to the valve (18, 23), such that the actuating means of the piston (13) is correctly positioned with respect to the valve; the closure (5) is mounted to the second

cylinder (2), and the second cylinder (2) and the container (50; 60) are joined in their respective bottom regions.

19. Manufacturing method as claimed in claim 18, wherein the container (50; 60) is formed from a synthetic material by injection stretch blow-moulding.

20. Manufacturing method as claimed in claim 18 or 19, wherein the second cylinder (2) is formed form a synthetic material by injection blow moulding.

21. Manufacturing method as claimed in claim 20, wherein the synthetic material is PET.

22. Manufacturing method as claimed in one of claims 18 to 21, wherein the closure (5) is mounted to the second cylinder (2) by vibration or ultrasonic welding.

23. Manufacturing method as claimed in one of claims 18 to 22, wherein the second cylinder (2) and the container (50; 60) are joined by laser welding.

24. Manufacturing method as claimed in claim 23, wherein the container (50; 60) is made of a transparent plastic material and the second cylinder (2) is made of a laser energy absorbing plastic material.

25. Manufacturing method as claimed in one of claims 18 to 24, wherein the second cylinder (2) is pressurized with an inert gas immediately after filling the container (50; 60) with a liquid.

AMENDED CLAIMS

[received by the International Bureau on 11 January 2005 (11.01.05);
original claims 1-27 replaced by new claims 1-24 (5 pages)]

1. Pressure control device (1) in a pressure control system for maintaining a constant predetermined excess pressure arranged in a fluid dispensing container (50; 60), said pressure control device comprises a cylinder (15) having an open end and a closed end, and a piston (13) movable within said cylinder defining a first chamber (16) to be filled with a gas for exerting said predetermined excess pressure, a second chamber (7), a passageway from the second chamber (7) to the outside of the device leading to the fluid dispensing container (50; 60), a valve (18, 23) for releasing and closing said passageway, wherein the second chamber (7) is formed by a high-pressure container (2) with a closed end (34) and an open end provided with a rim part (4) and said container (2) being filled with a gas at a pressure higher than said predetermined excess pressure, and said piston (13) having means for actuating said valve dependent from the pressure difference between the first chamber (16) and the fluid dispensing container (50; 60), so that if the fluid pressure in the container drops below the predetermined excess pressure, gas flows from the second chamber (7) to the container until the container pressure approximately equals said predetermined pressure, characterized in that a closure (5) is mounted to the rim part (4) of the high-pressure container (2) in order to close the second chamber (7), wherein the first chamber (16) is part of the closure, such that the high-pressure container (2) is encompassing the cylinder (15) of the first chamber (16).

2. Pressure control device as claimed in claim 1, wherein the volume of the first chamber (16) is substantially smaller than the volume of the second chamber (7).

3. Pressure control device as claimed in claim 1 or 2, wherein the high-pressure container (2) is a second cylinder.

4. Pressure control device as claimed in one of claims 1 to 3, wherein the initial pressure of the gas in the second chamber (7) is defined by the formula:

$$P_2 \geq P_1 * (1 + V_1 / V_2)$$

wherein P_1 = the predetermined excess pressure
P_2 = the initial pressure in the second chamber
V_1 = the volume of the fluid dispensing container
V_2 = the volume of the second chamber

5. Pressure control device as claimed in one of claims 1 to 4, wherein the closure (5) comprises a closing element (9A, 9B) commensurate to the rim part (4) of the high-pressure container (2) and means (26) for mounting the first cylinder (15) of the first chamber in the closure (5).

6. Pressure control device as claimed in claim 5, wherein the upper end of the high-pressure container (2) has a tapered neck portion (3).

7. Pressure control device as claimed in claim 6, wherein the closure (5) comprises a steplike funnel (6) directed inwardly to the neck portion (3).

8. Pressure control device as claimed in claim 5 or 6, wherein the closing element is an inner circular groove (10) of the closure (5) which is mounted to the rim part (4) of the high-pressure container by means of vibration or ultrasonic welding.

9. Pressure control device as claimed in one of claims 1 to 8, wherein the high-pressure container (2) has a central bottom opening (36) locked by a plug (37) for pressurizing the second chamber (7) with a gas.

10. Pressure control device as claimed in claim 1, wherein the high-pressure container (2) is made of a plastic material by injection blow moulding.

11. Pressure control device as claimed in claim 10, wherein the high-pressure container (2) is made of PET.

12. Pressure control system comprising a pressure control device (1) as claimed in one of claims 1 to 11, and a fluid dispensing container (50; 60), wherein the container is formed from a plastic material as a bottle and the high-pressure container (2) is welded to the inner wall of the container, whereas the inner side of the bottle and the outer side of the high-pressure container (2) are adapted to form an interference press-fit connection.

13. Pressure control system as claimed in claim 12, wherein the high-pressure container (2) is laser welded to the inner wall of the fluid dispensing container (50; 60).

14. Pressure control system as claimed in claim 12 or 13, wherein the fluid dispensing container (50) has a dispensing opening with a dispensing valve (51), and a movable piston (52) is provided in the container between the pressure control device and the dispensing opening, which piston is separating the fluid and the gas, and which is movable towards the dispensing opening by the excess pressure prevailing in the container.

15. Pressure control system as claimed in claim 14, wherein the movable piston (52) is designed as a dome with annular sealing ribs (53, 54).

16. Pressure control system as claimed in claim 15, wherein the movable piston (52) is made of a resilient plastic material.

17. Pressure control system as claimed in claim 12 or 13, wherein the container (60) has a dispensing opening (61) with a dispensing valve (62), and a dip-tube (68) is provided from the entry of the dispensing valve (62) to the upper end of the pressure control device (1), in order to dispense the fluid through the dip-tube by the excess pressure prevailing in the container.

18. Pressure control system as claimed in claim 17, wherein the dispensing valve (62) has a spray nozzle (64).

19. Method for manufacturing a pressure control device (1) as claimed in one of claims 1 to 11, wherein a first cylinder (15) is formed; the piston (13), the

valve elements (18, 23) and the high-pressure container (2) with the closed end and the rim part (4) at the open end, and the closure (5) are formed out of a synthetic material of high stability; a central opening (36) is formed in the bottom of the container (2); the piston (13) is assembled with a sealing ring (14) in the first cylinder (15), whereas a gas is filled in the first chamber (16) at a predetermined pressure; the first cylinder (15) is mounted with respect to the valve (18, 23), such that the actuating means of the piston (13) is positioned correctly with respect to the valve; the closure (5) is mounted to the high-pressure container (2).

20. Manufacturing method as claimed in claim 19, wherein the closure (5) is mounted to the high-pressure container (2) by vibration or ultrasonic welding.

21. Manufacturing method as claimed in claim 20 or 21, wherein the high-pressure container (2) is formed form a synthetic material by injection blow moulding.

22. Manufacturing method as claimed in claim 21, wherein the synthetic material is PET.

23. Manufacturing method of a pressure control system according to one of claims 12 to 18 and according to the method of one of claims 19 to 22, wherein a fluid dispensing container (50; 60) is formed; the bottom of the container is cut off: and the high-pressure container (2) and the fluid dispensing container (50; 60) are joined in their respective bottom regions.

24. Manufacturing method as claimed in claim 23, wherein the fluid dispensing container (50; 60) is formed from a synthetic material by injection stretch blow-moulding.

25. Manufacturing method as claimed in claim 23 or 24, wherein the high-pressure container (2) and the fluid dispensing container (50; 60) are joined by laser welding.

26. Manufacturing method as claimed in claim 25, wherein the fluid dispensing container (50; 60) is made of a transparent plastic material and the high-pressure container (2) is made of a laser energy absorbing plastic material.

27. Manufacturing method as claimed in one of claims 23 to 26, wherein the high-pressure container (2) is pressurized with an inert gas immediately after filling the fluid dispensing container (50; 60) with a fluid.

STATEMENT UNDER ART. 19(1) PCT

Claim 1 has been amended commensurate to the remarks in part V of the written opinion, whereas the expression "second cylinder (2)" has been amended to "high-pressure container (2)". Moreover, new claim 1 is now directed to a "pressure control device in a pressure control system". The amendment of "second cylinder (2)" to "high-pressure container (s)" can be derived immediately from the description on page 4, line 12 and on page 7, lines 3 to 5, and lines 12 and 13.

New claims 2 to 11 have been directed to a "pressure control device" as claimed in claim 1.

New claims 2, 4 to 11 are essentially identical to existing claims 2 to 10. New claim 3 has been added.

New claim 12 is directed to a "pressure control system" comprising the pressure control device and a fluid dispensing container. The new introduced feature of "an interference press-fit connection" has been described in the description on page 6, lines 22 to 29. The other features are from existing claim 10.

New claims 13 to 18 are commensurate to existing claims 12 to 17.

New claim 19 is now directed to the manufacturing of the "pressure control device". This new claim 19 is essentially identical to existing claim 18, whereas the last feature thereof has been deleted.

New claims 20, 21, 22, 23, 24, 25, 26 and 27 are essentially identical to existing claims 22, 20, 21, remaining features of claim 18, 19, 23, 24 and 25 (abusively numbered again "24"), respectively.